

Exhibit 30

12/8/94

IF FILTER BREAKDOWN
GILLNETTER TOWNS SHIP
WATER FOR SUENT- DEF-412
FASSE FASL-13.

APS3200 Bleed System
In Service Review Meeting

APS3200 Bleed System

Ed Edelman

December 5, 1994

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12/2/94

Agenda / Overview	APS3200 Bleed System In Service Review Meeting
<ul style="list-style-type: none">• Agenda / Overview<ul style="list-style-type: none">– Bleed System Design Review– Test Requirements– ΔP/P Sensor Status– V3.0 Schedule– ECB Retrofit Program Schedule– PCR Status– Summary / Action Items	

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Bleed System Design Review	APS3200 Bleed System In Service Review Meeting
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- Bleed System Design Review

- Bleed System Overview
- Surge Fault Protection
- Reverse Flow Fault Detection
- Low Bleed Pressure during MES
- APU Bleed Dispatch Reliability
- Summary of Software and Hardware Changes

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Problem Statement	APS3200 Bleed System In Service Review Meeting
<ul style="list-style-type: none">• Load Compressor Bleed System Control Problem Statement:<ol style="list-style-type: none">1. Inadequate surge fault detection, leading to continuous surge with CEC-IMO sensor failures and eventually IGV bushing failure and APU replacement.2. No reverse flow detection, which may lead to APU failure upon A/C check valve failure.3. Low bleed pressure during MES, preventing main engine starts or resulting in hot main engine starts.4. Non-activation of bleed system (BCV full bypass) upon failure of BCV, IGV, delta P, P7, T7, T2 or P2, resulting in poor APU bleed system dispatch reliability.	

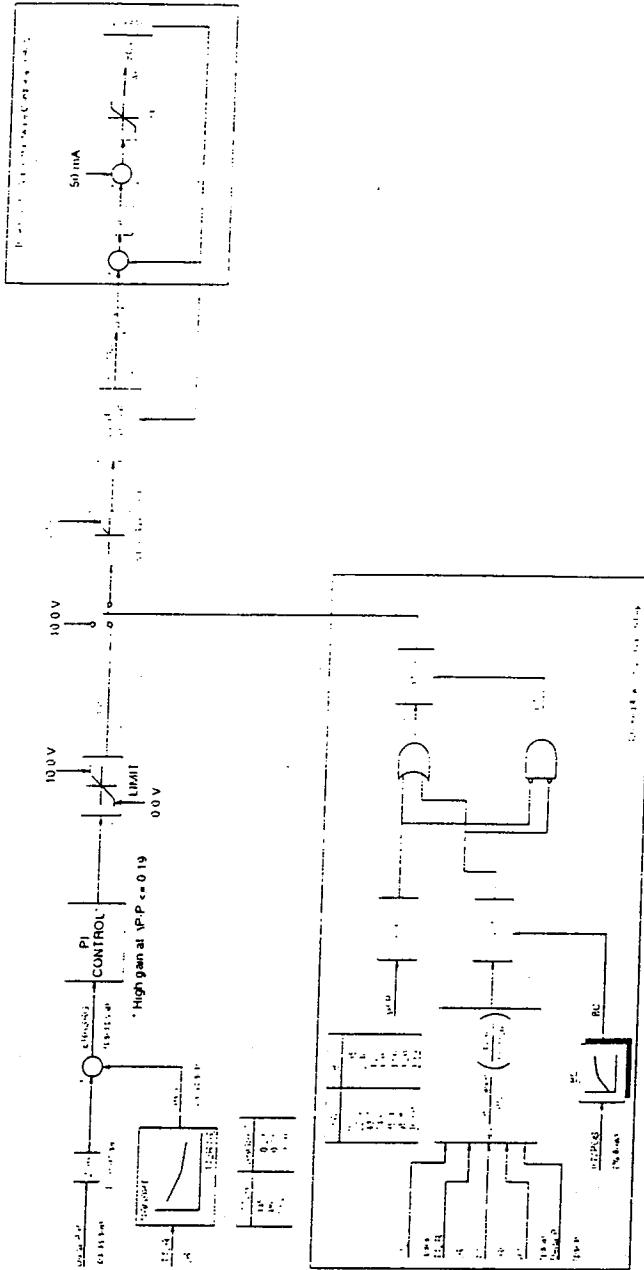
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Overview of Bleed Control System

APS3200 Bleed System In Service Review Meeting

- **V2.6.8 Surge Control Overview (simplified)**



☐ New for V3.0

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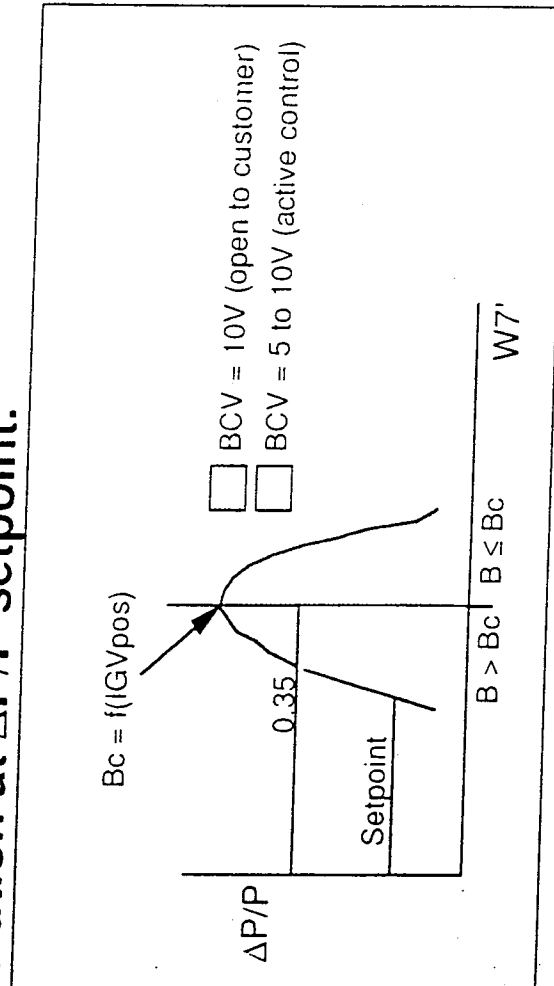
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Overview of Bleed Control System

APS3200 Bleed System In Service Review Meeting

- B-factor used to distinguish low vs. choked flow due to dual solution at $\Delta P/P$ setpoint.



B-factor Flow Prediction, where $B = \frac{P_{lcd} - \Delta P}{P_{inlet}} \left(\frac{T_{inlet}}{T_{lcd} - T_{inlet}} \right)$

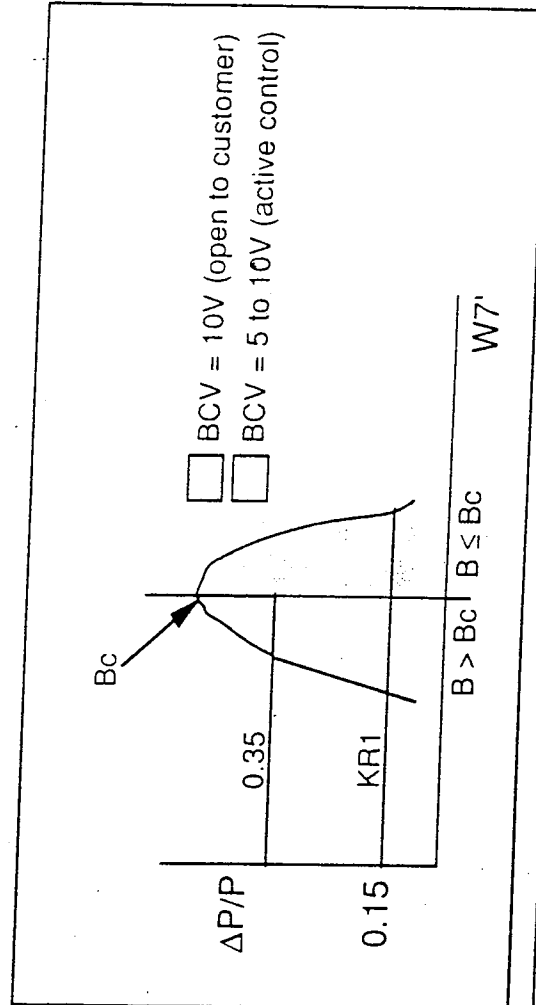
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Surge Fault Detection

APS3200 Bleed System
In Service Review Meeting

- Existing Fault Detection Logic
Delta $P/P < KR1$ (surge limit exceeded) removed during development program due to false fault declarations associated with B-factor Miscalculation due to Tlcd transient behavior.



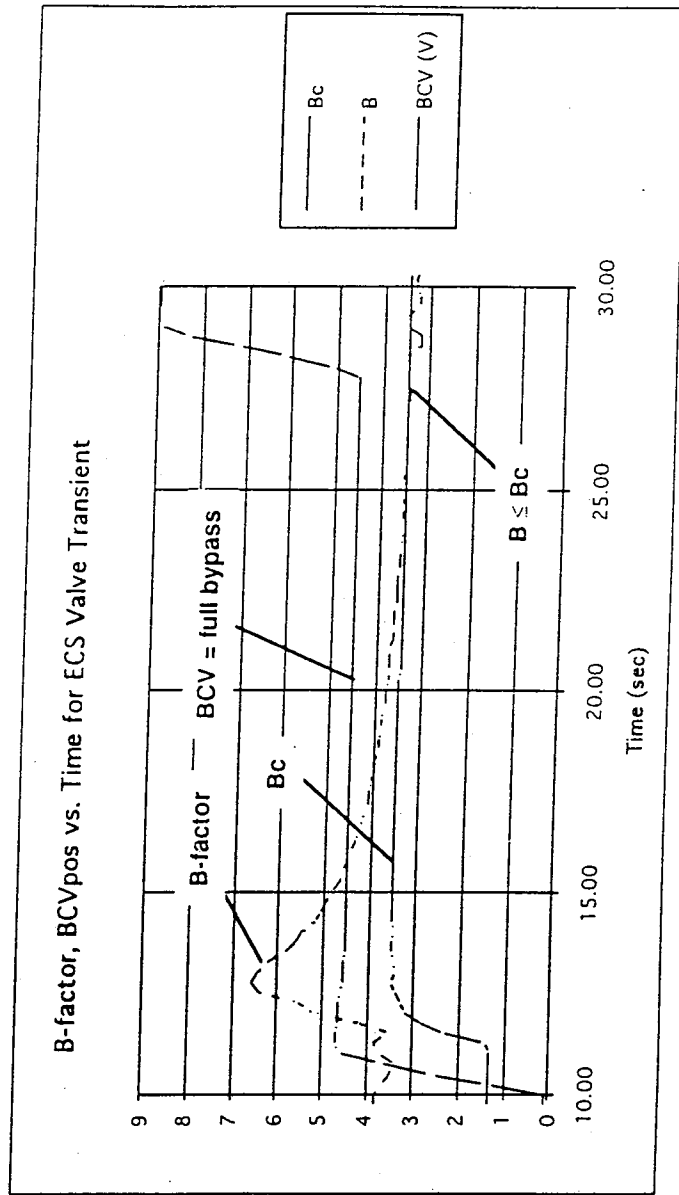
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Surge Fault Detection

APS3200 Bleed System In Service Review Meeting

- Load Compressor Discharge Sensor Dynamics Results in Miscalculation of B-factor (continued)



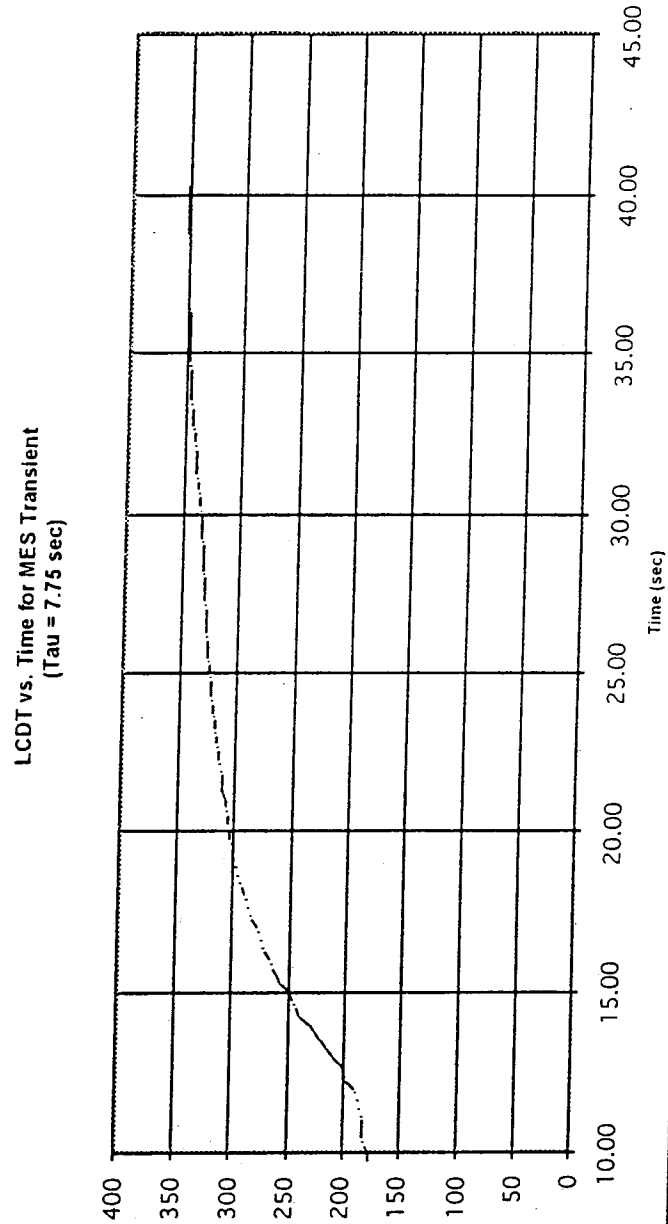
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Surge Fault Detection,
continued

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In Service Review Meeting

• Load Compressor Discharge Sensor Dynamics Results
in Miscalculation of B-factor



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Surge Fault Detection, continued

APS3200 Bleed System In Service Review Meeting

- Proposed fault detection logic isolates surge based on rate of change of P7 and Rate of change of Delta P.
Two fault classes:

- Single surge event due to control system undershoot.
- Continuous surge (4 surges in 15 seconds) due to negative surge system margin (IMO sensor failure).

Fault Description (RS232 Message)	SSL	Fault Cause (LRU)	APU Operation (Impact)
LC Surge	4	None	None
Surge Limit Exceeded	4	None	None
Continuous LC Surge	4	LCP Transducer	Bleed System Deactivation
Continuous LC Surge and BCV Mechanically Failed Open	2	LCP Transducer or LCP Transducer or A/C Check Valve	APU Shutdown
Reverse Flow	4	A/C Check Valve	Bleed System Deactivation
Reverse Flow and BCV Mechanically Failed Open	2	LCP Transducer or A/C Check Valve	APU Shutdown

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Surge Fault Detection, continued

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• Several surge detection methods considered:

Proposed Surge Detection		Pros	Cons
Move inlet pressure/temperature sensor to load compressor side of inlet plenum		Pressure rise and temperature rise provide accurate surge and reverse flow detection method.	Requires hardware change in addition to software modification
Replace slow response T7 with fast response T7		Temperature rise can be used to detect surge and continuous surge.	Requires hardware change and must be used in conjunction with pressure measurement.
$\Delta P/P \leq 0.15$ psid/psia.		Simple and reliable software solution if sensor measurements are accurate	<ul style="list-style-type: none"> Requires ΔP and P7 input filter change in ECB hardware to improve frequency response (currently 5 Hz). Sensor measurement shifts may result in non-detection.
Rate of Change of ΔP and Rate of Change of P7.		<ul style="list-style-type: none"> Provides accurate method for detecting interruption in flow due to surge. Not dependent on sensor accuracy. Effective even with sensor drift. 	<ul style="list-style-type: none"> Complicated implementation. Must distinguish ΔP and P7 flow interruptions due to surge from IGV transients and ECS/MES valve transients

Rate of change of ΔP and rate of change of P7 selected as best method

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Surge Fault Detection, continued

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- Surge system margin tolerance stack-up (surge margin = 0.05 psid/psia)

☐ Problem areas include CEC/IMO out-of-tolerance pressure transducers and transient undershoot due to 5 Hz. ΔP and P7 input filter.

Surge Margin Contribution	System Margin (a) (psid/psia)	System Margin (Worst Case) (psid/psia)
Engine Deterioration		
Sensor Variation	0.013 ⁸	0.043 ⁹
Sensor Variation, Ambient Temperature Effects	0.005 ¹¹	0.005
ECB Component Variation	0.013 ^{1,2,3,4}	0.038 ^{1,2,3,5}
Software Resolution	0.0002 ¹	0.0002
Steady-state Margin	0.024 ¹⁰	
Control Undershoot	0.026 ⁶	0.028
ECB Input Filter Undershoot	0.027 ⁷	0.01
Total of Transient Undershoot	0.053	0.029
Sum of Steady-state and Transient Undershoot	0.077	

* Information currently not available

- 1 Assumes worst-case calculation error for AP and P7 (AP ± 1 AND P7 ± 1)
- 2 Assumes operating point of AP/P7 ± 0.2 , AP ± 11 psid and P7 ± 35 psia, on a typical MES operating condition, Seallevel/Status/Standard Day
- 3 Input amplifier, gain resistor, MUX, and conversion error, input and A/D conversion offset error. Based on -40 °C to +90 °C operating range. Based on component manufacturer tolerances
- 4 Individual errors are RSS values
- 5 Assumes worst-case on summation of individual errors
- 6 Based on MES valve transient, MES valve closure ± 0.9 sec, test performed on SPS subsection, worst case result
- 7 Input filter ± 4 Hz. For 25 Hz filter, undershoot ± 0.018 psid/psia
- 8 P7 based on operating point of 56 psia. Represents 3 σ distribution, mean ± 56.42 psia, population of seven sensors. AP based on operating point of 10 psid. Represents 3 σ distribution, mean ± 10.11 psid, population of 8 sensors. 1 σ sensors in population not included (SN 580015 and SN 580027)
- 9 Worst case variation based on SN 580015, assumes AP ± 10 psid, P7 ± 30 psia. Measured AP ± 7.5 psid, P7 ± 48 psia
- 10 RSS of sensor variation, ECB component variation and sum of software resolution, sensor temperature effects
- 11 Test performed on one sensor at Lamb ± 240 F

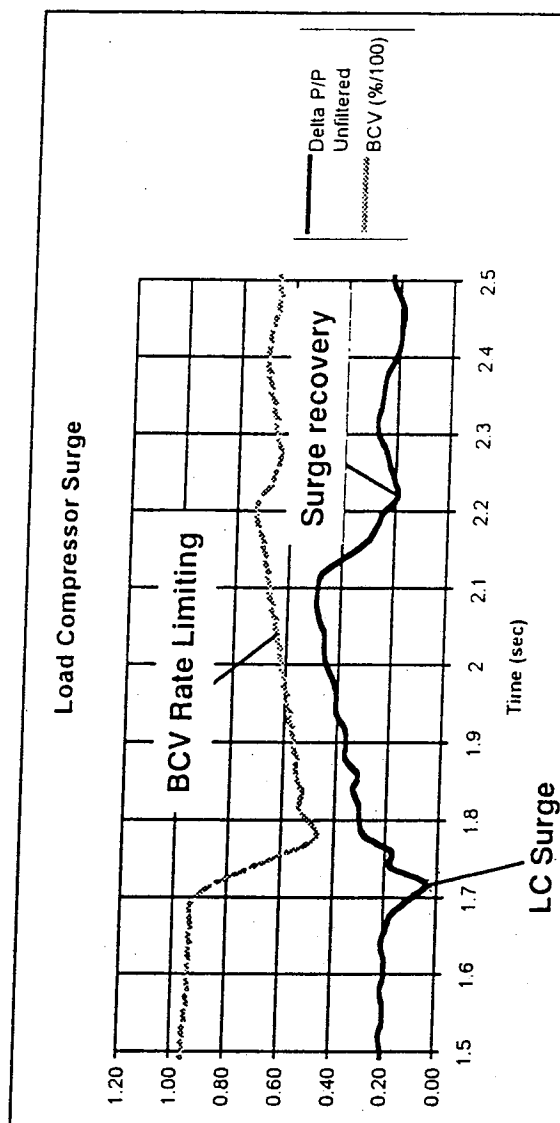
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Surge Fault Detection, continued

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- Single surge event due to transient undershoot. Surge control recovers due to unidirectional BCV rate limit.



* Test performed with 250 msec. facility valve and non representative volume. Surge cannot be duplicated in Tail section without lowering setpoint.

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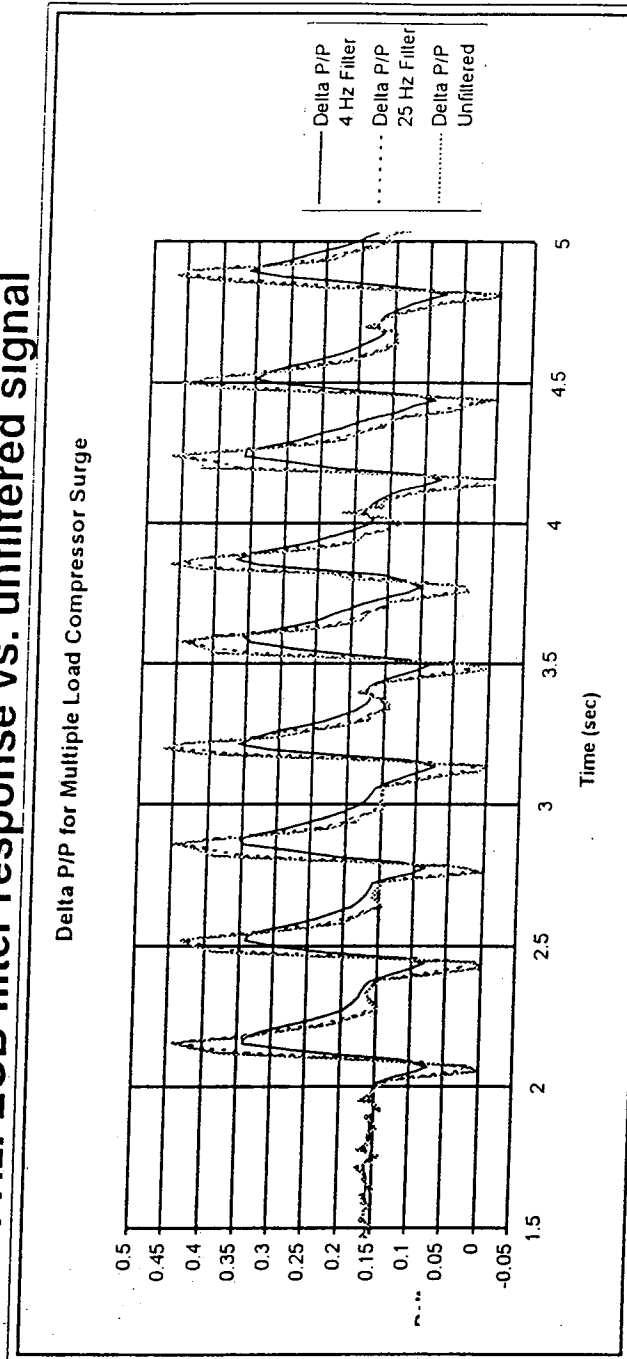
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Surge Fault Detection,
continued

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- Continuous surge induced at Turbomeca by disabling bleed system (BCV removed).

— 4 Hz. ECB filter response vs. unfiltered signal

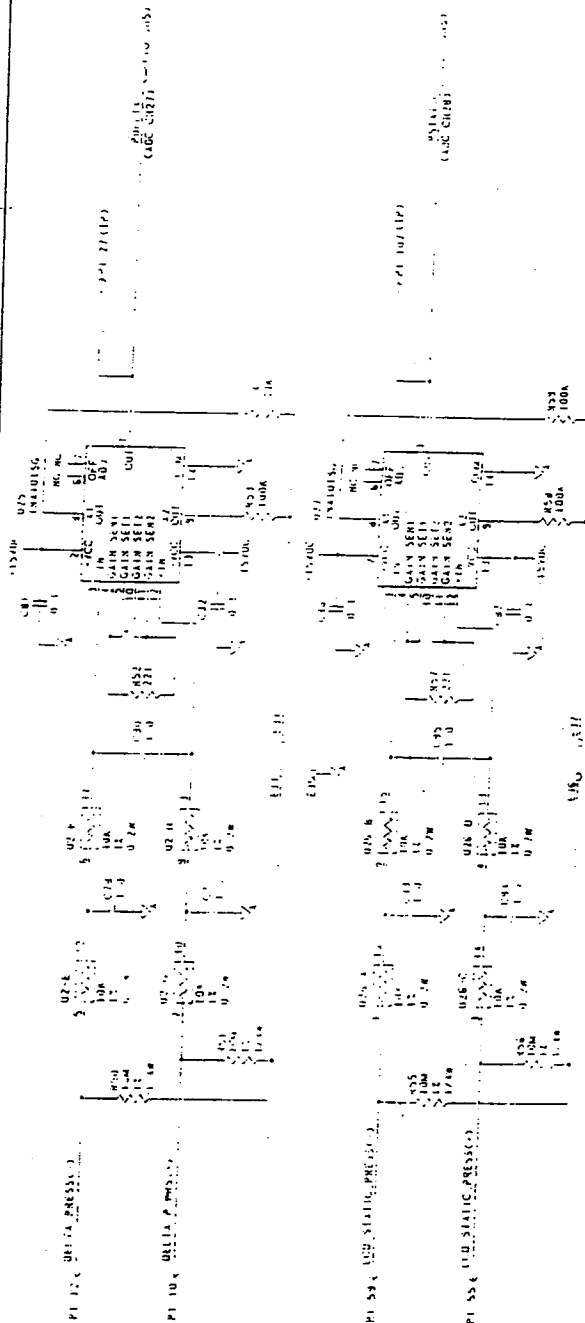


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Surge Fault Detection, continued

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$$G(s) = \frac{1}{(\tau_s + 1)(4\tau_s + 1)}$$

Existing:

U2-E = U2-F = U2-G = U2-H = 10 kΩ
C = C78 = C79 = C80 = 1.0 μF
f = 4, 16 Hz

Proposed:

U2-E = U2-F = U2-G = U2-H = 10 kΩ
C = C78 = C79 = C80 = 0.25 μF
f = 16, 64 Hz

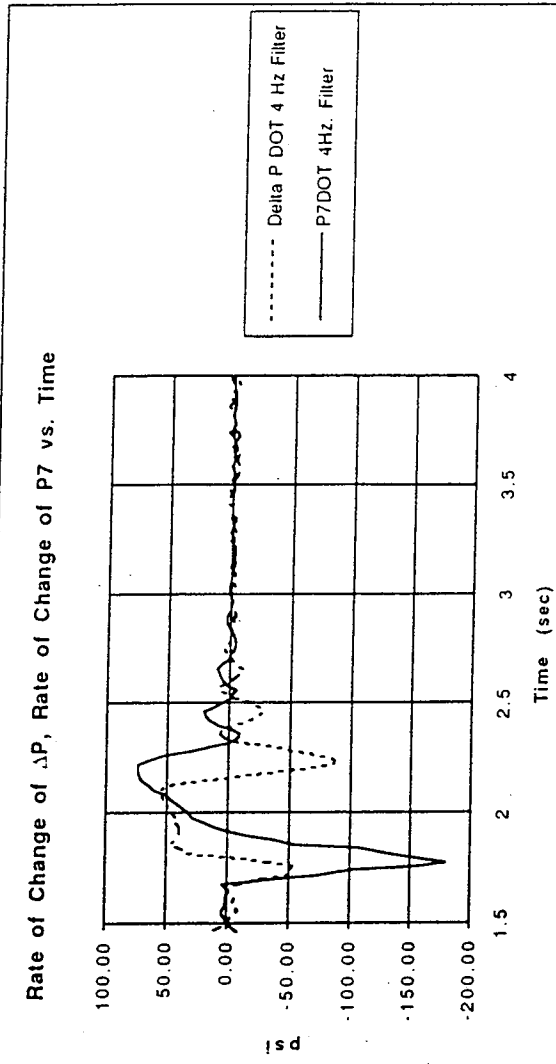
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Surge Fault Detection,
continued

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- Surge detected based on rate of change of ΔP and rate of change of LCDP.
- “Soft” sensor failure does not compromise surge detection



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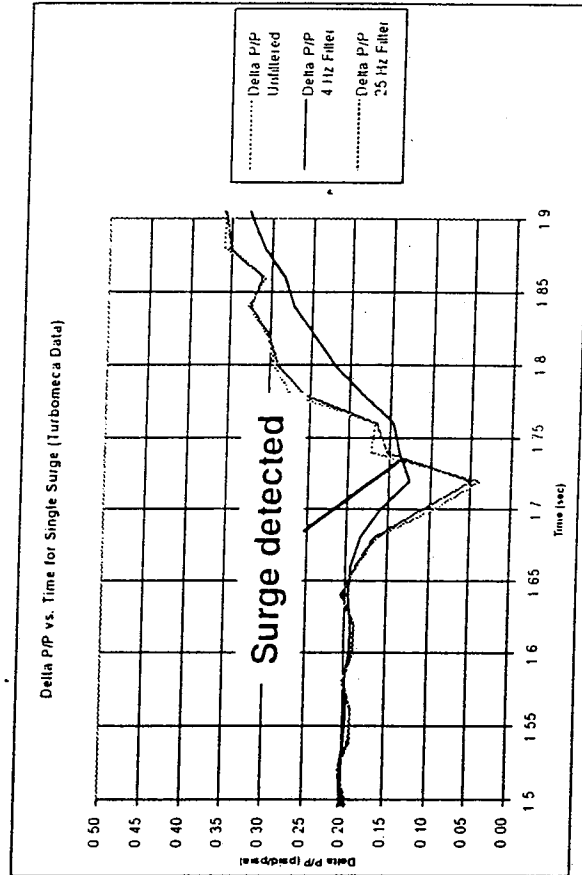
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Surge Fault Detection, continued

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- 4-Hz. hardware filter effects fault detection based on $\Delta P/P$ alone.



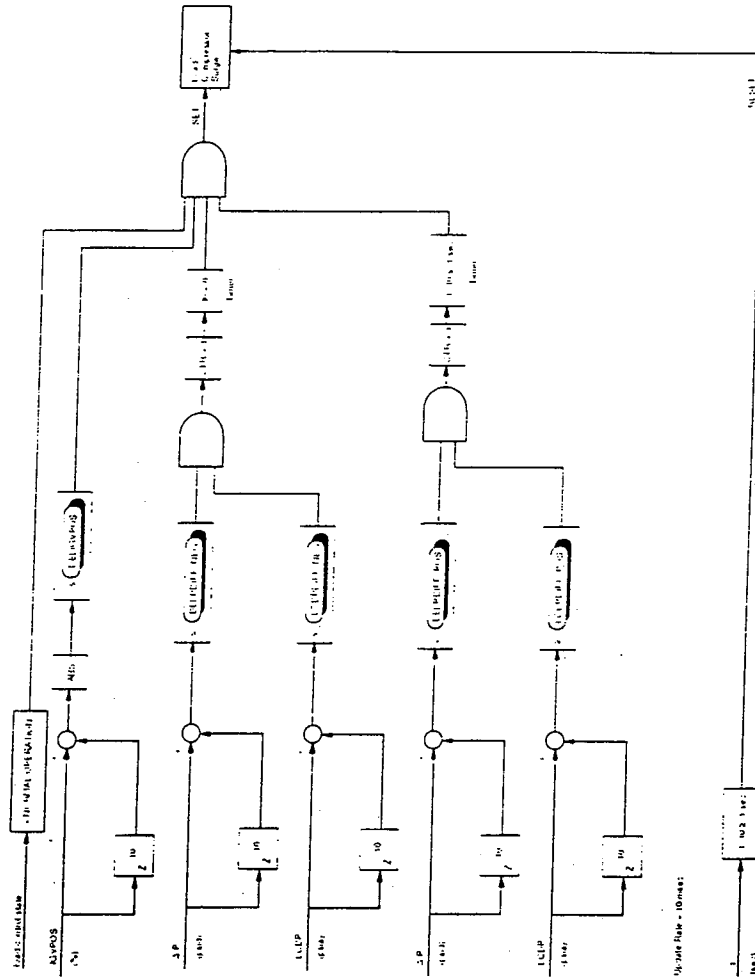
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Surge Fault Detection, continued

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- Load Compressor surge detection based on rate-of-change of ΔP and $\Delta P/P$.



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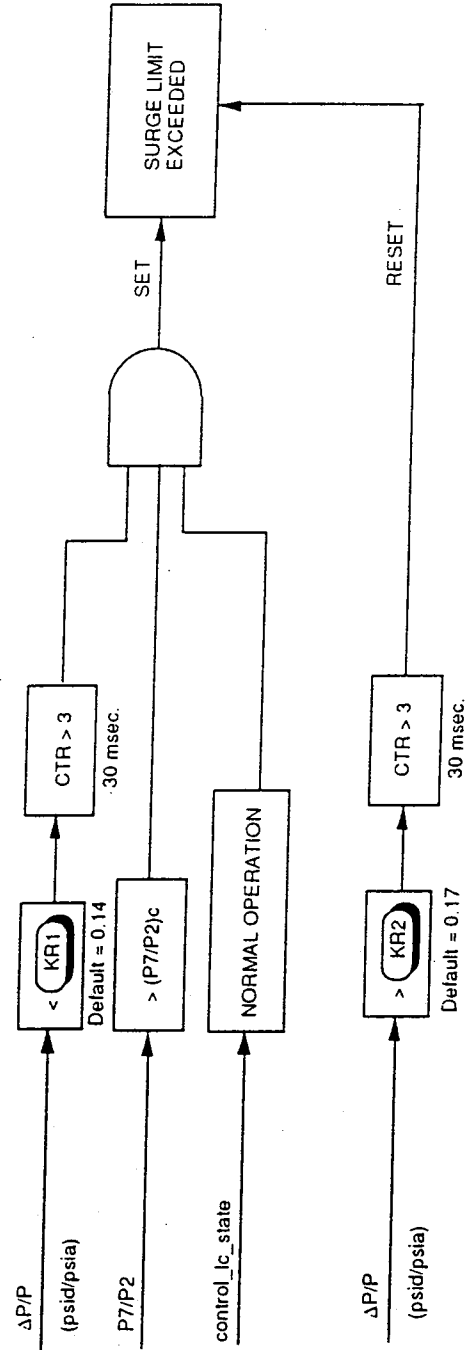
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Surge Fault Detection, continued

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- Surge limit exceeded dependent on $\Delta P/P$ level.



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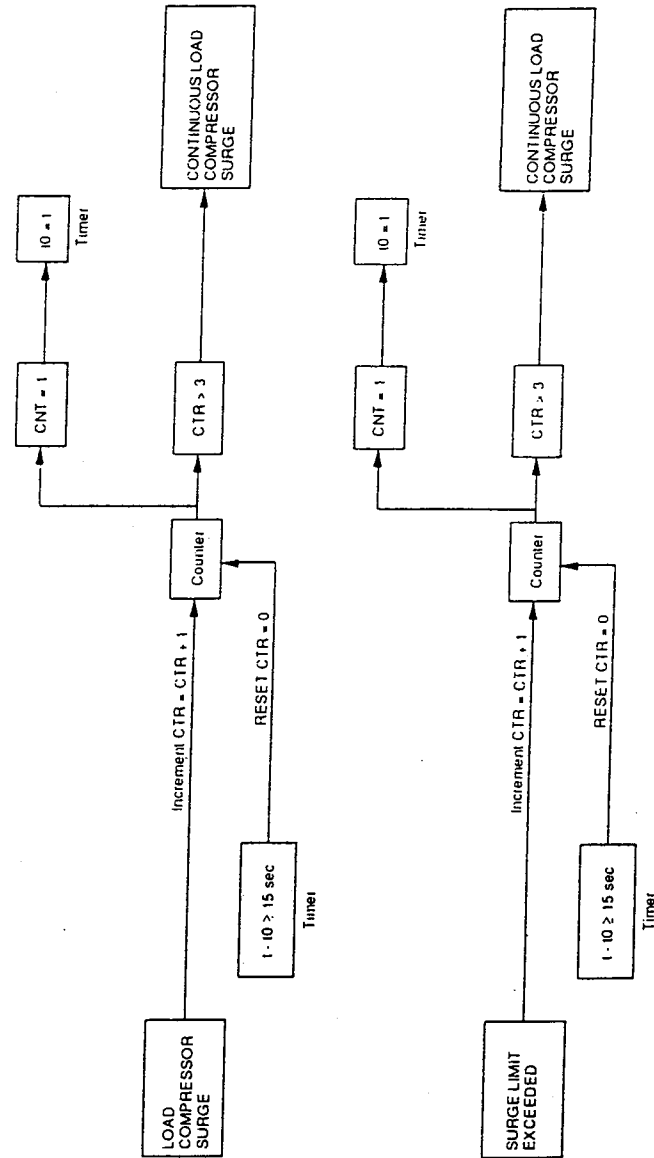
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Surge Fault Detection, continued

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- Continuous surge detected if four consecutive surges occur within 15 sec., resulting is disabling of bleed system.



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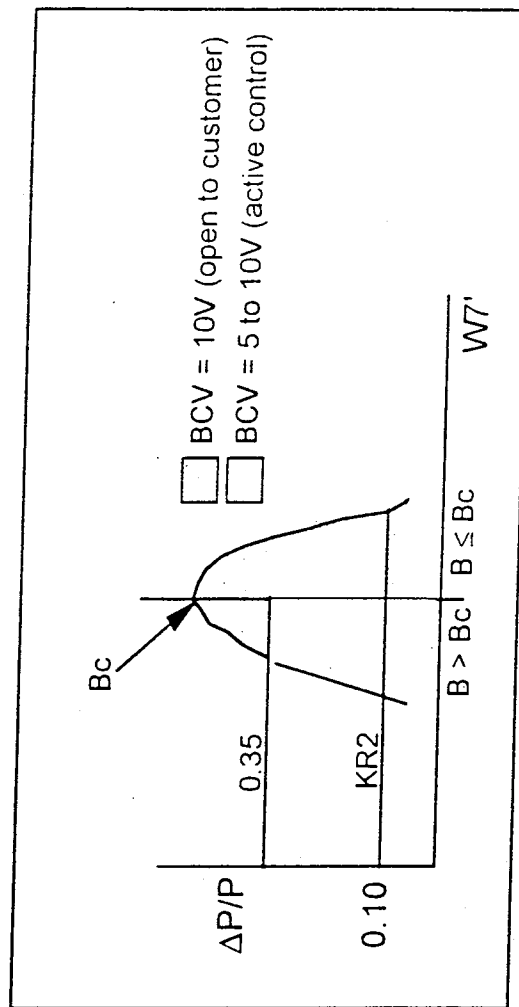
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Reverse Flow Fault Detection

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- **V2.0.2 Fault Detection Logic**
Delta $P/P < KR2$ (reverse flow) removed during development program due to false fault declarations associated with B-factor Miscalculation



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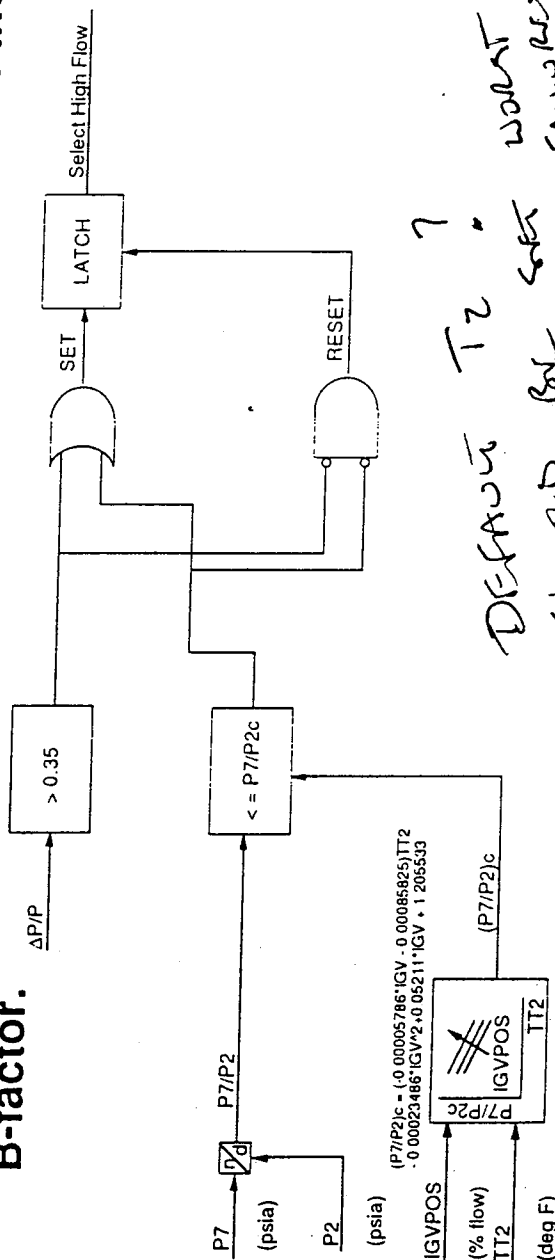
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- **V3.0 Reverse Flow Fault Detection**

- B-factor replaced with Load Compressor Pressure Ratio (P7/P2)c to eliminate Load Compressor Discharge Temperature Dynamic Effects and miscalculation of the B-factor.**



DEFACED T2 7
SHOULD BE GET T2
SO BEL MTD
WANT CASE. DO NOT
BORN.

CAUSE 22

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APC

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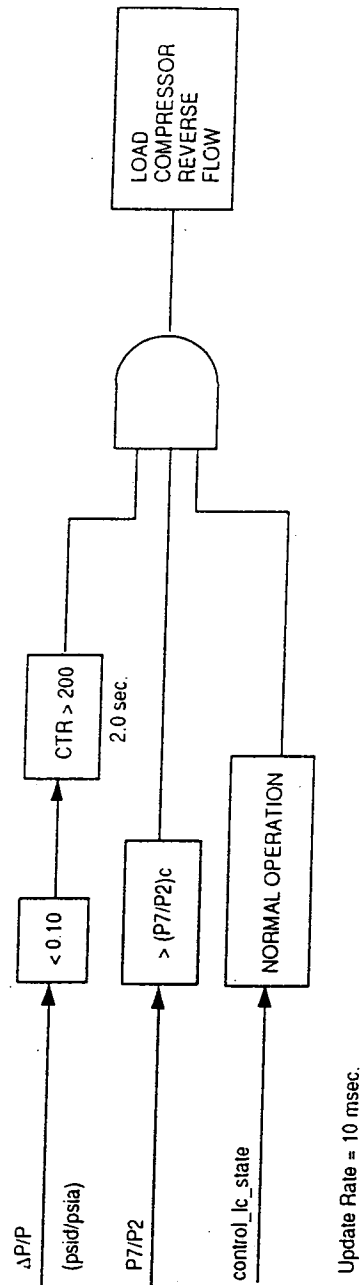
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Reverse Flow Fault Detection, continued

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- Proposed fault detection logic isolates reverse flow
 - Replacement of B-factor with Load Compressor Pressure Ratio (P7/P2)c eliminates nuisance shutdowns due to LCDT sensor dynamics and miscalculation of the B-factor.



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Low Bleed Pressure during MES	APS3200 Bleed System In Service Review Meeting
<ul style="list-style-type: none">• Low bleed pressure during MES. Pilot observes bleed pressure less than 10 psia during Main Engine Start.<ul style="list-style-type: none">– Problem not linked to BMC power interrupt of load command signal.<ul style="list-style-type: none">» 130 msec interrupt not sufficient to interrupt air flow due to IGV and BCV rate limiting during bleed sequencing off.– Problem may be linked to BMC “lock-up” problem.<ul style="list-style-type: none">» BMC can continuously command 10V signal when lock-up occurs (normally 0 V = bleed on / 15 V = bleed off). Deadband in ECB (4.25 V positive going threshold, 8.0 V negative going threshold) permits bleed off command during BMC lock-up.	

Low Bleed Pressure during MES, continued	APS3200 Bleed System In Service Review Meeting
<ul style="list-style-type: none">• Low bleed pressure during MES, continued<ul style="list-style-type: none">– Problem <i>may</i> be due to simultaneous opening of ECS and MES valves, unique to the V2500 main engine.<ul style="list-style-type: none">» 4-5 second overlap of ECS and MES signals may result in unexpected high flow condition and false fault declaration of delta P sensor.	

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<p>Low Bleed Pressure during MES, continued</p>	<p>APS3200 Bleed System In Service Review Meeting</p>
<ul style="list-style-type: none"> • Low bleed pressure during MES, continued <ul style="list-style-type: none"> – Known problem due to B-factor miscalculation, delta P sensor false fault declaration (recorded during A/C ground test) » B-factor miscalculation due to T7 sensor dynamics results in temporary full-bypass flow. » High flow condition results in deltaP false fault declaration ($\Delta P < 1.75$ psid) 	

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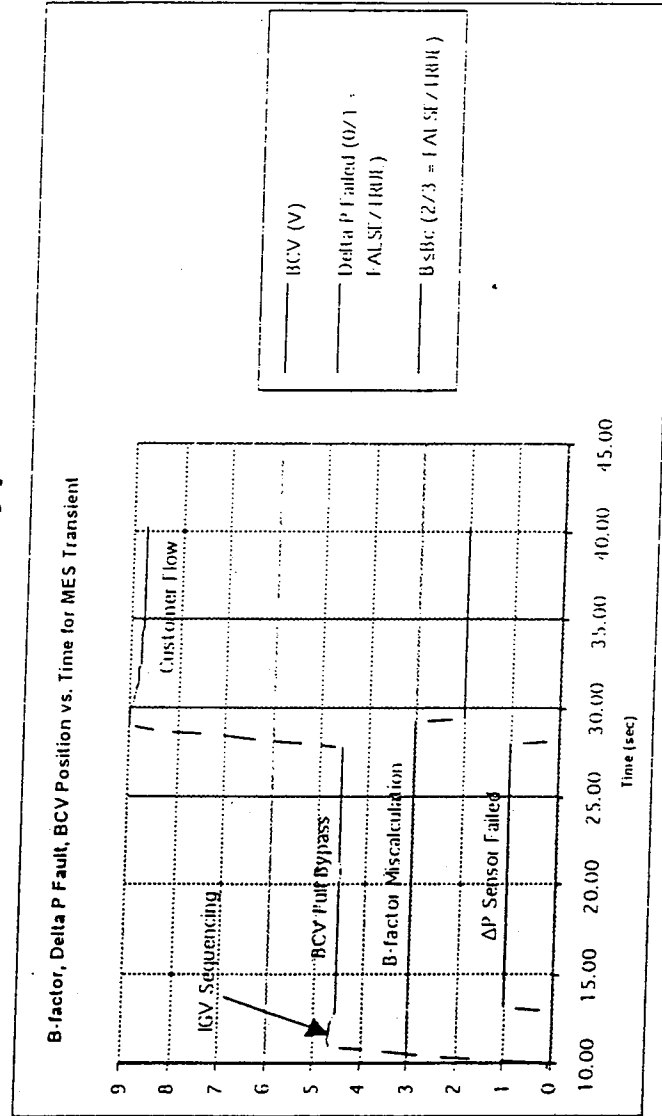
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Low Bleed Pressure
during MES, continued

APS3200 Bleed System
In Service Review Meeting

- B-factor miscalculation, delta P sensor false fault declaration results in full bypass flow



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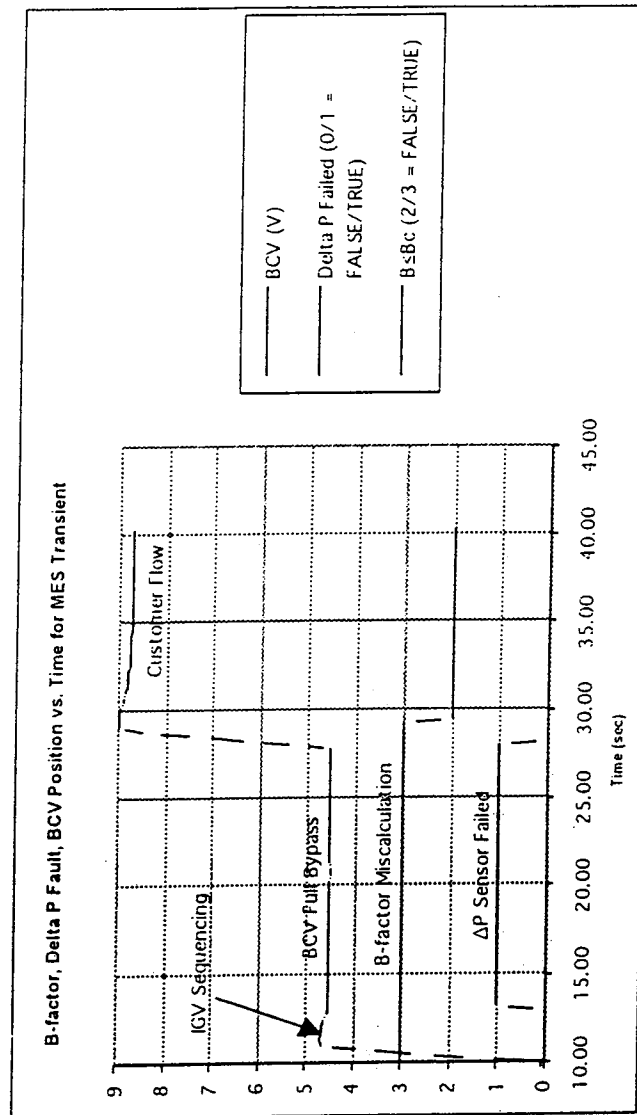
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Low Bleed Pressure
during MES, continued

APS3200 Bleed System
In Service Review Meeting

- B-factor miscalculation, delta P sensor false fault declaration results in full bypass flow



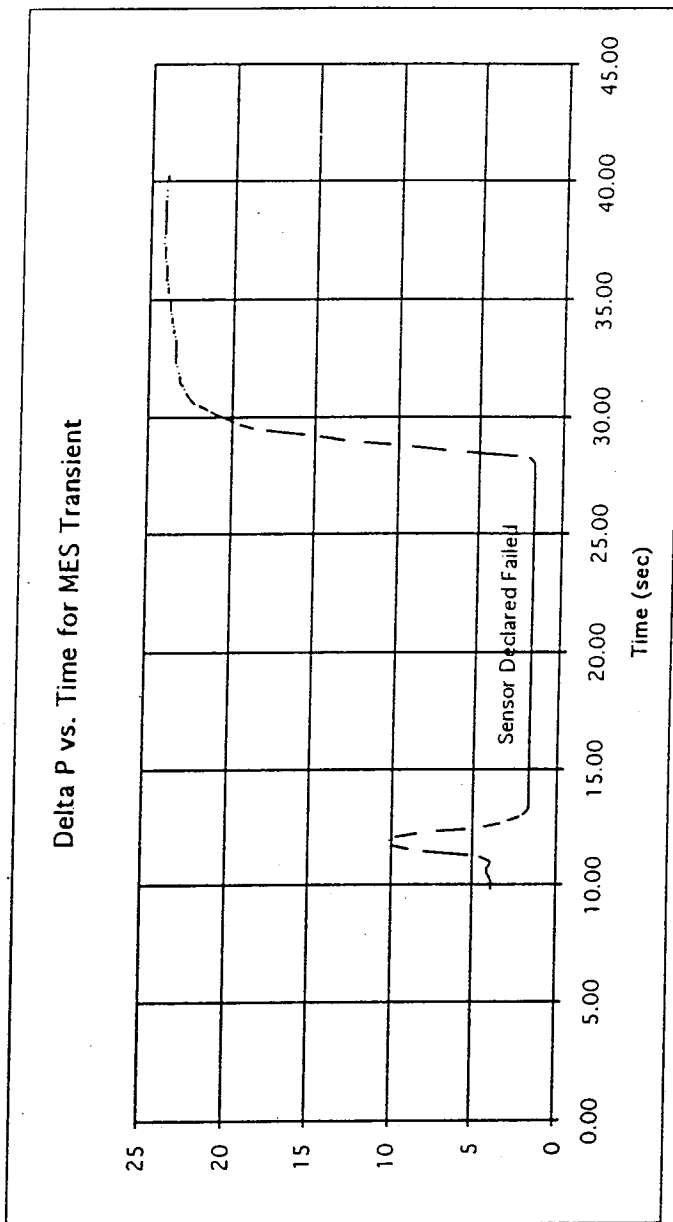
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Low Bleed Pressure
during MES, continued

APS3200 Bleed System
In Service Review Meeting

- Delta P sensor false fault declaration contributed to Full Bypass Flow



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Low Bleed Pressure during MES, continued	APS3200 Bleed System In Service Review Meeting
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• **Low bleed pressure during MES**
Solution:

- Replace B-factor (a function of T7) with LC Pressure Ratio (P7/P2)c
- Reduce delta P fault indication from 1.75 psid (7% of full-range output) to 0.875 psid (3.5% of full-range output) to account for simultaneous MES and ECS demand or BCV full bypass during MES.

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APU Bleed System Dispatch Reliability	APS3200 Bleed System In Service Review Meeting
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- Version 3.0 improves bleed system dispatch reliability
 - B-factor replaced with load compressor pressure ratio, eliminating LCDT sensor control requirement
 - Tinlet and Pinlet use LCDT and LCDP upon failure

What?

Transducer	V2.0.2	V3.0
Pinlet	●	●
Tinlet	●	●
LCDP	●	●
LCDT	●	○
LCAP	●	●

- No effect on BCV
- Requires dual sensor failure before bypassing bleed (BCV = 50%)
- Bypasses bleed flow (BCV = 50%) upon sensor failure.

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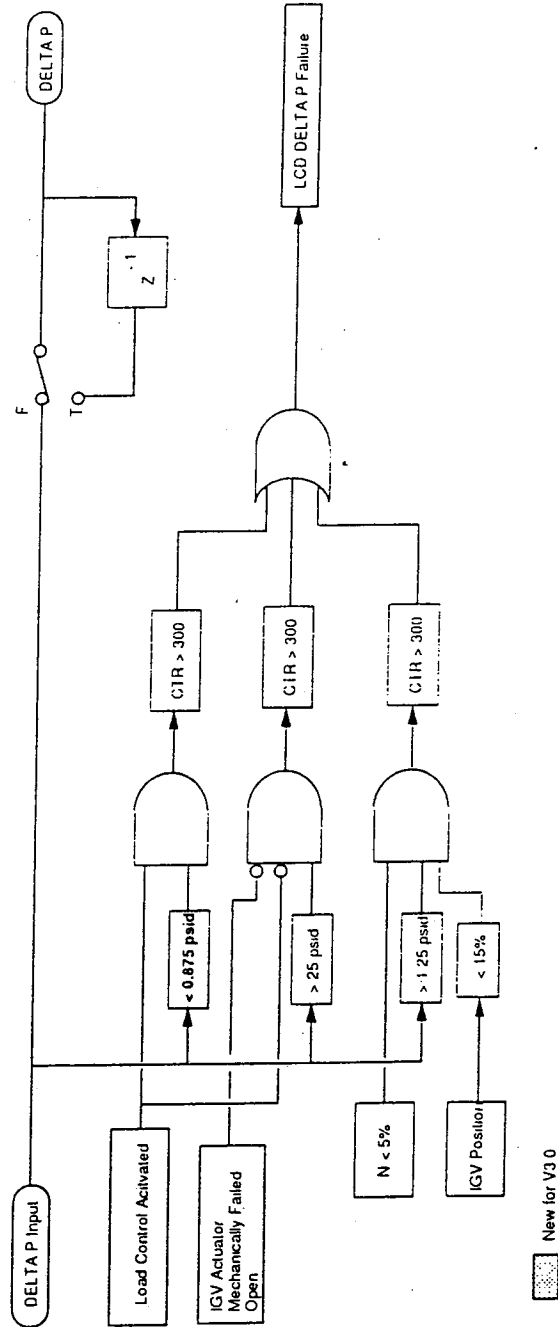
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APU Bleed System Dispatch Reliability

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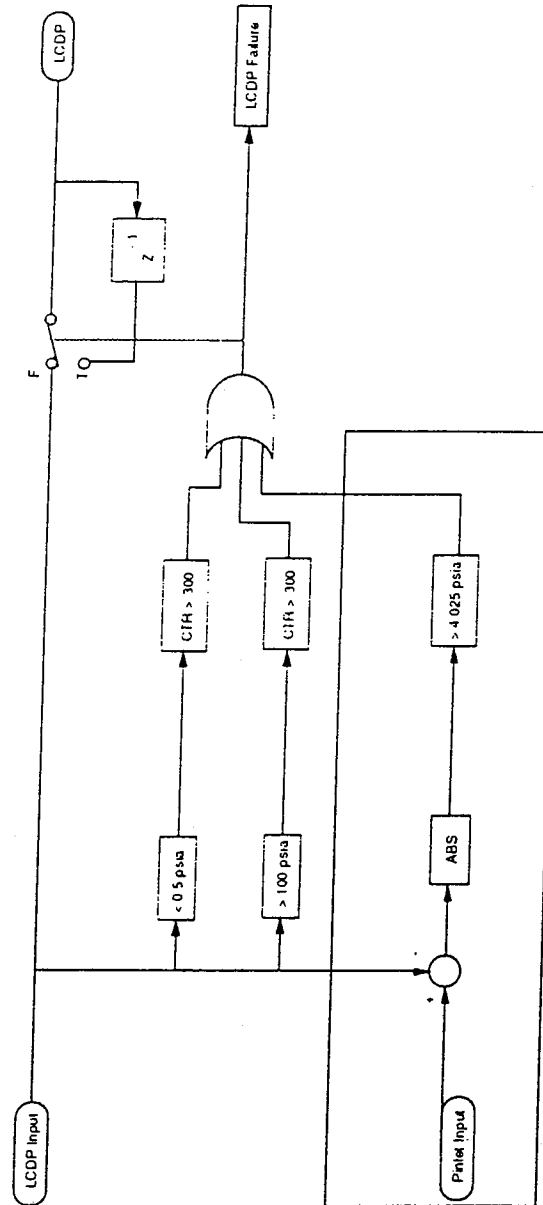
• Load Compressor ΔP transducer fault logic



APU Bleed System Dispatch Reliability

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• Load Compressor Discharge Pressure Transducer Fault Logic



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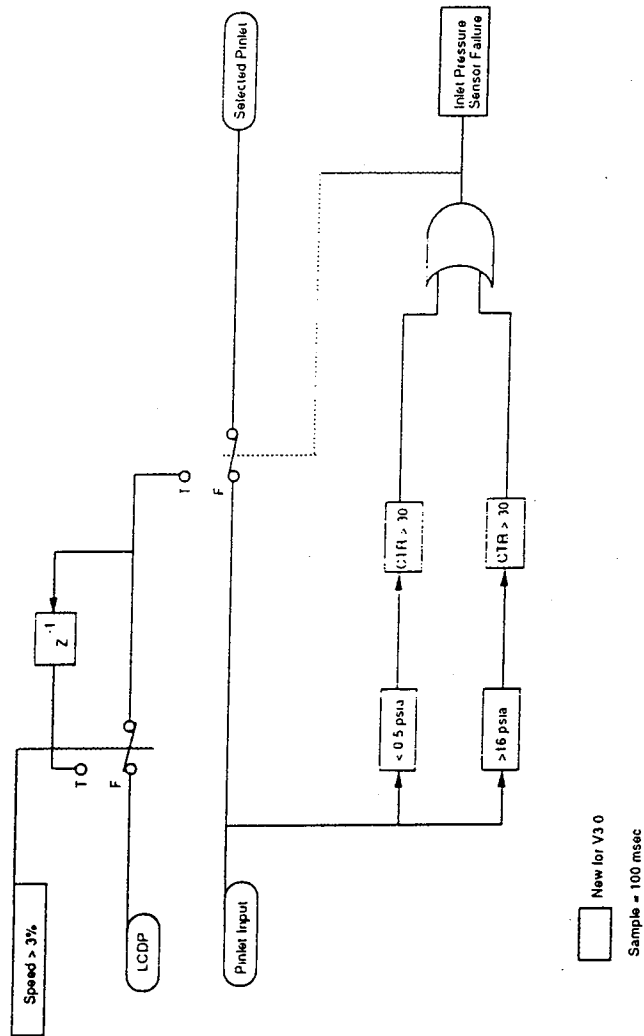
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APU Bleed System
Dispatch Reliability

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In Service Review Meeting

• Inlet Pressure Transducer Fault Logic for Bleed System



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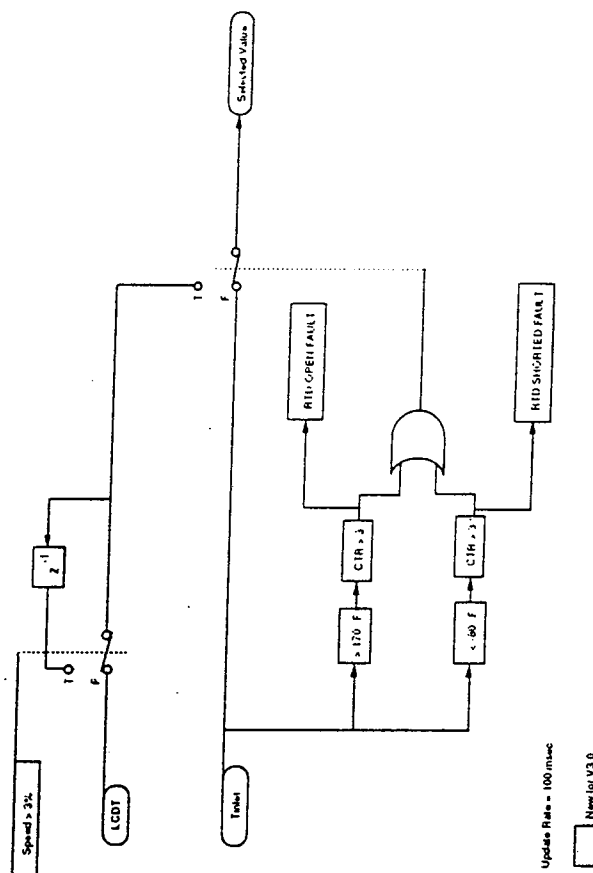
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APU Bleed System Dispatch Reliability

APS3200 Bleed System In Service Review Meeting

- **Inlet Temperature Transducer Fault Logic for Bleed System**



1. CO_2
 2. SO_2
 3. CO
 4. H_2S
 5. NH_3
 6. H_2
 7. CH_4
 8. H_2O
 9. O_2
 10. N_2

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**Summary of Hardware and
Software Changes**

**APS3200 Bleed System
In Service Review Meeting**

• **Summary of Proposed Changes**

– **V3.0 Software Changes**

- » Choked flow predictor change (P7/P2)c
- » Surge fault detection
- » Reverse flow fault detection
- » 7% range check on Pinlet and Pstatic sensors
- » ΔP logic modification to prevent false fault declaration during high flow conditions
- » Pinlet and Tinlet fault logic for improved dispatch reliability

– **ECB input filter on ΔP and P7 change from 4 Hz. to 15-25 Hz.**

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Testing Requirements

APS3200 Bleed System In Service Review Meeting

• Testing Requirements

- Development Testing: Low Bleed Pressure during MES, surge fault protection with and without faulty sensor, testing of dispatch reliability logic, reverse flow logic.
 - " Low Bleed Pressure during MES, including testing of the (P7/P2)c at all bleed conditions.
 - " Surge fault detection, including compatibility with the faulty CEC-IMO sensor.
 - " Testing with and without the ECB filter modification.
 - " Reverse flow tests with a pressurized MES bleed duct.
 - " Dispatch mode reliability (test sensor failures), including the affects of soakback on LCDT.
- Software Validation:
 - " Functional validation will be conducted prior to flight test to ensure proper control and safety related operation. In addition, lessons learned during V2.0.3 will be added to the test program, ensuring proper software replacement. Complete validation will be performed on V3.0.

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**APS3200 Bleed System
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• Testing Requirements (continued)

- Software Throughput Tests will be performed during HSIT, engine test and aircraft test. Design goal = 10%.
 - " Software task monitoring (in V2.6.8) provides an accurate accounting of throughput margin. Testing with worst-case ARINC traffic will be conducted, which exceeds the requirements observed on the aircraft with V2.6.8. All tasks in all phases of operation will meet the goal of 10% throughput margin.
- HSIT Test
 - " The complete HSIT test will be conducted, including a detailed throughput analysis.
- Compatibility Test
 - " The pneumatic portion of the compatibility test will be conducted prior to aircraft testing.
- Safety Test
 - " Required prior to aircraft testing.
- Software/APU Integration Test
 - " This test insures the integrity of the control system and software by exercising all of the control loops, maximizing software throughput, testing NVM by adjusting parameters and exercising all of the operating states.

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**APS3200 Bleed System
In Service Review Meeting**

• **Testing Requirements (continued)**

- Aircraft Compatibility Tests. Validation of the software will be conducted during a two month evaluation period on the aircraft. Included in the tests will be:
 - " Low Bleed Pressure during MES.
 - " Proper bleed operation throughout the flight envelope.
 - " Surge fault detection, including compatibility with the faulty CEC-IMO sensor.
 - " Software throughput margin.
 - " Check valve failure (reverse flow) test.

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Δ P/P Sensor Status	APS3200 Bleed System In Service Review Meeting
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- Dual suppliers - CEC/IMO and Kulite
- CEC/IMO had manufacturing defect
 - Resulted in positive shift in measured Δ P/P, resulting in continuous APU surge
 - Six engines removed due to continuous surge
- Kulite - no operational failures to date
 - Retrofit of CEC/IMO sensors with Kulite
 - » SB 4500001-49-23 Complete 1st Quarter of 1995
 - Evaluating stress screening of sensor
 - » Vibration, temperature, pressure

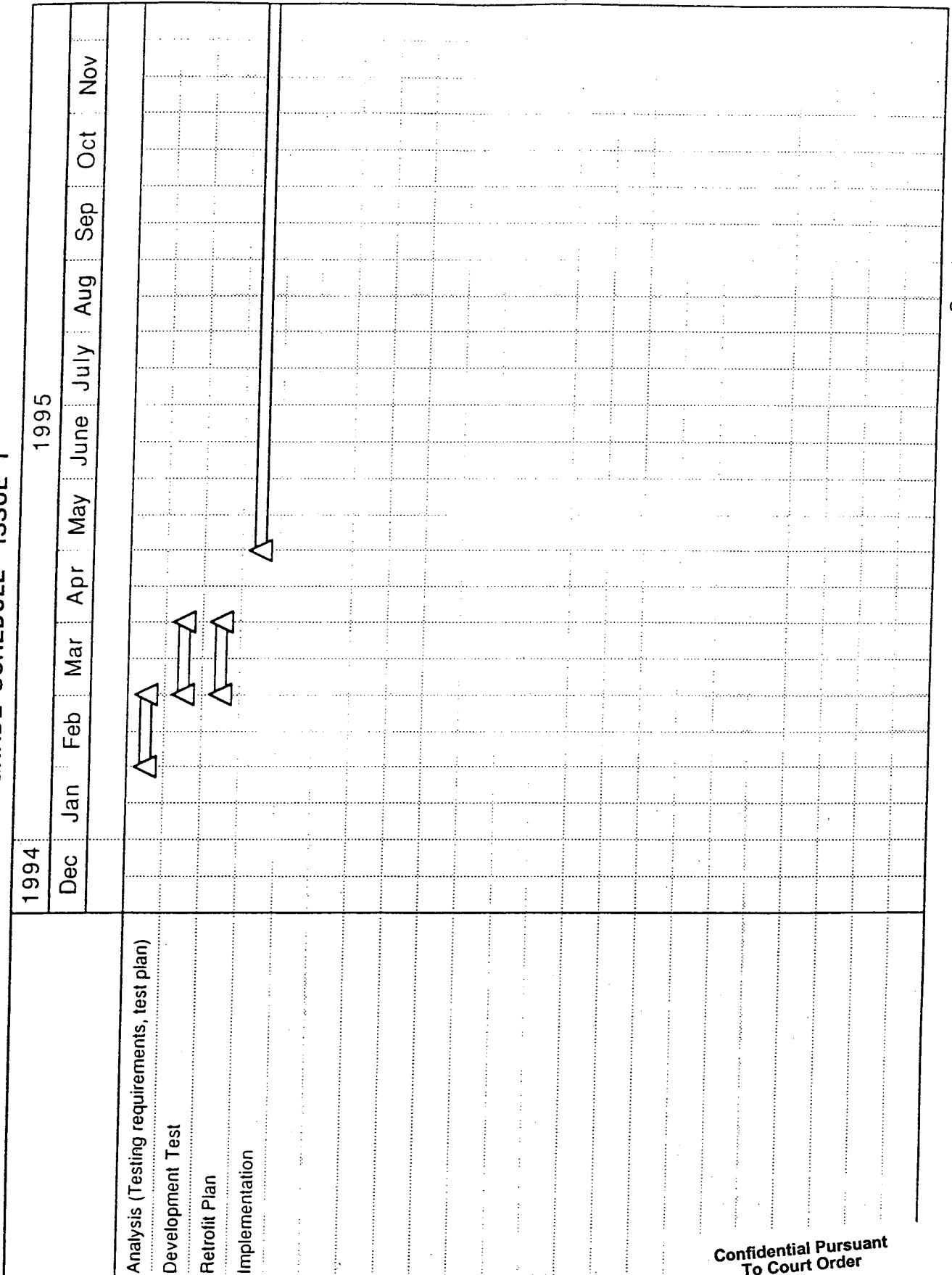
Confidential Pursuant
To Court Order

HSA 226774

Auxiliary Power International Corp.
A Joint Company of Labinal And Sundstrand Corp.



ECB DELTA P / P HARDWARE FILTER UPGRADE SCHEDULE ISSUE 1

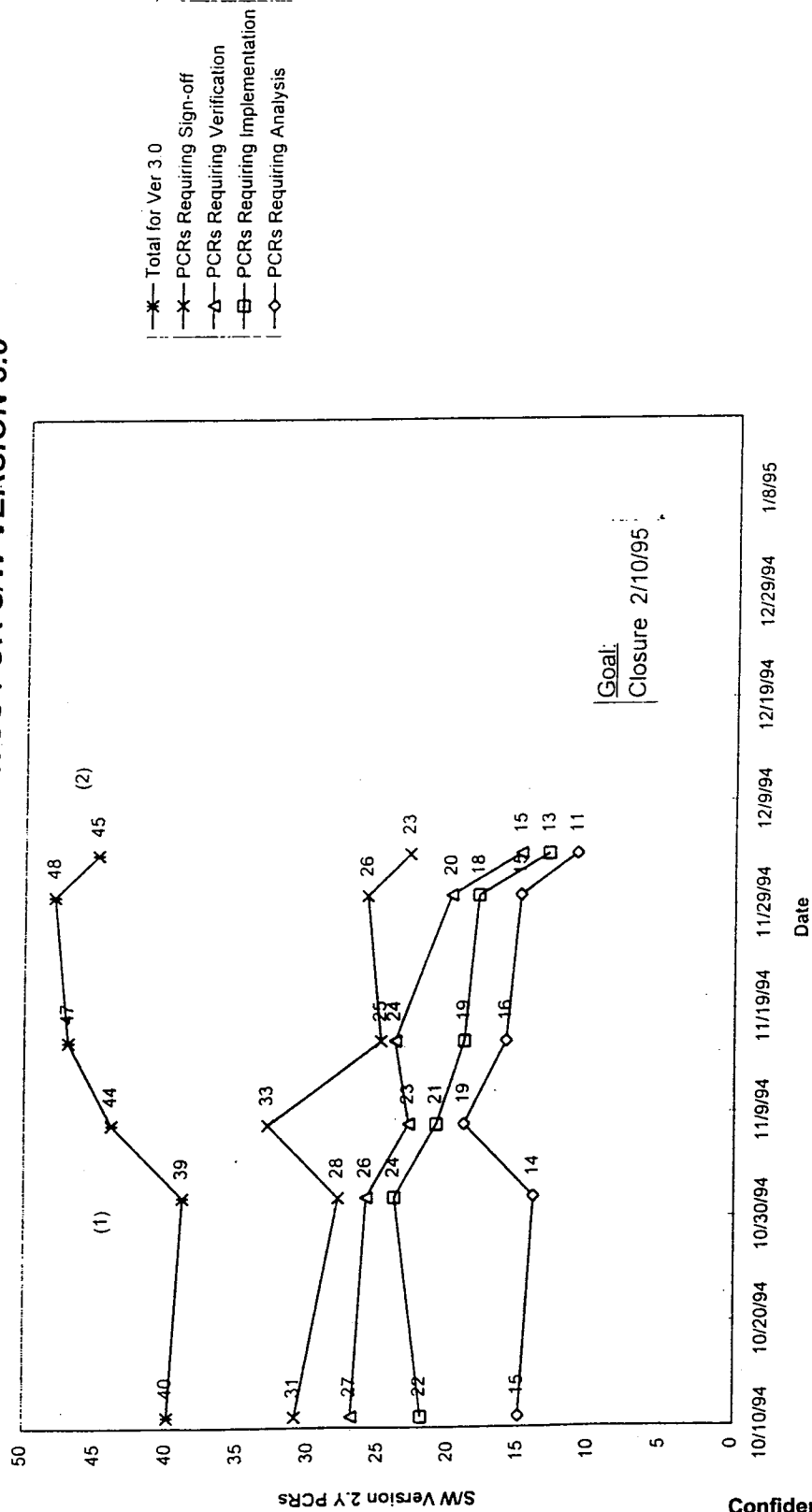


Sunday December 4 1994

Confidential Pursuant
To Court Order

HSA 226775

APS3200 PCR STATUS FOR S/W VERSION 3.0



Confidential Pursuant To Court Order

HSA 226776

(1) DGAC Audit
 (2) PCR 1121 (MIT Improvements), PCR 1163 (LRU Identification Page Flash), PCR 1173 (MIT during Shutdown) Removed

Prepared by Ed Edelman
 cc: S. Lampe O. Kiuse A. Kayvan J. Lanham B. Pierce

12/4/94

Exhibit 31

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL, INC.,)
and HONEYWELL INTELLECTUAL)
PROPERTIES, INC.,)

Plaintiffs,)

vs.)

No. 99-309-GMS

HAMILTON SUNDSTRAND CORP.,)

Defendant.)

VIDEOTAPED DEPOSITION OF JIM CROCKER CLARK
Volume 1 (Pages 1- 278)
Phoenix, Arizona
December 6, 2005
9:00 a.m.

PREPARED FOR:
District Court
(Original)

PREPARED BY:
Robin L. B. Osterode, RPR, CSR
AZ Certified Reporter No. 50695

<p>134</p> <p>1 good person to call?</p> <p>2 A. I don't think he would know either; he</p> <p>3 couldn't tell you specifically either, I don't think.</p> <p>4 Q. How did -- describe for me the logic in</p> <p>5 the 331-350 where IGV position was used to determine</p> <p>6 whether the double solution issue existed?</p> <p>7 A. Can you repeat the question?</p> <p>8 Q. Describe for me the logic in the 331-350</p> <p>9 that used inlet guide vane position to determine</p> <p>10 whether the double solution issue existed?</p> <p>11 A. Yeah, I think I already replied to that.</p> <p>12 There's a -- I believe there's a schedule in there,</p> <p>13 it's got inlet guide vane position and pressure</p> <p>14 inputs, and it makes a decision on which side of the</p> <p>15 curve you're on.</p> <p>16 Q. Does it compare inlet guide vane position</p> <p>17 to a pressure ratio?</p> <p>18 A. Does it compare inlet guide vane position</p> <p>19 to a pressure ratio?</p> <p>20 Q. In this schedule.</p> <p>21 A. The inputs to the schedule, I think, are,</p> <p>22 if I recall my memory, is in inlet guide vane</p> <p>23 position and then there's some pressure, some --</p> <p>24 Q. Why does the double solution problem</p> <p>25 occur in the 331-350?</p>	<p>136</p> <p>1 problem, don't you need two static pressure</p> <p>2 measurements, two static pressure ports?</p> <p>3 A. No, you can have a total in static.</p> <p>4 Q. So in the -- in any APU that uses the</p> <p>5 Delta P/P flow-related parameter, if the static</p> <p>6 pressure measurement in that parameter is taken in</p> <p>7 the diffuser and if you get supersonic flow in the</p> <p>8 diffuser, you'll experience the double solution</p> <p>9 problem?</p> <p>10 MS. STEVENSON: Objection; asked and</p> <p>11 answered several times.</p> <p>12 THE WITNESS: Any time you get supersonic</p> <p>13 flow in the diffuser, you get a distortion to that</p> <p>14 curve.</p> <p>15 BY MR. LIND:</p> <p>16 Q. The double solution curve?</p> <p>17 A. It makes the double solution curve.</p> <p>18 Q. Do all of the Honeywell APUs you listed</p> <p>19 earlier that use the Delta P/P flow-related parameter</p> <p>20 take the static pressure measurement in the diffuser?</p> <p>21 MS. STEVENSON: Object to the form.</p> <p>22 THE WITNESS: The 331s -- the 331s all</p> <p>23 do, I believe.</p> <p>24 BY MR. LIND:</p> <p>25 Q. The 331-200, therefore --</p>
<p>135</p> <p>1 A. Because the static ports were put down in</p> <p>2 the diffuser.</p> <p>3 Q. So any time you put static pressure ports</p> <p>4 in the diffuser, you can exhibit -- and you get</p> <p>5 supersonic flow in the diffuser, you'll experience</p> <p>6 this double solution problem?</p> <p>7 A. Yes, that's right.</p> <p>8 Q. Where are the static ports in the</p> <p>9 331-50-- I'm sorry, where are the static pressure</p> <p>10 ports within the 331-350 diffuser?</p> <p>11 A. I don't know where they are exactly,</p> <p>12 they're down -- they're in the diffusers and I don't</p> <p>13 know the location, that was -- if that was the</p> <p>14 question.</p> <p>15 Q. Yes, sir.</p> <p>16 And is -- when you're -- the 331-350 uses</p> <p>17 your Delta P/P flow parameter in its surge control</p> <p>18 system, correct?</p> <p>19 A. That's correct.</p> <p>20 Q. So my understanding of the Delta P/P</p> <p>21 flow-related parameter is that it is total pressure</p> <p>22 minus static pressure over total pressure, correct?</p> <p>23 A. It's total pressure minus static</p> <p>24 pressure, that quantity over total pressure.</p> <p>25 Q. In order to get the double solution</p>	<p>137</p> <p>1 A. I'm sorry, the 331-200 and 250 do not</p> <p>2 have static taps in the diffuser; it's out in the</p> <p>3 duct.</p> <p>4 Q. Is the difference between the control --</p> <p>5 surge control logic to the 331-200 and the 331-350 be</p> <p>6 the location of the static pressure taps, then?</p> <p>7 A. That's correct.</p> <p>8 Q. Why did you move the static pressure tap</p> <p>9 from the duct in the 331-200 to the diffuser in the</p> <p>10 331-350?</p> <p>11 A. I don't know all the reasons, but I know</p> <p>12 one reason was to get a larger Delta P signal, which</p> <p>13 we previously discussed.</p> <p>14 Q. Because there's an advantage to having</p> <p>15 the static pressure measurement in the diffuser, as</p> <p>16 opposed to out in the duct?</p> <p>17 A. There's advantages and disadvantages and</p> <p>18 that's one of the advantages.</p> <p>19 Q. And Honeywell recognized that advantage</p> <p>20 in changing the surge control logic between the</p> <p>21 331-200 and the 331-350, correct?</p> <p>22 A. That was a recognized advantage.</p> <p>23 Q. And when did Honeywell recognize the</p> <p>24 advantage of measuring surge -- measuring static</p> <p>25 pressure in the diffuser, as opposed to the duct?</p>